Simultaneous 4/5 DOF S&R System

Quiet for S&R – Powerful for Durability – Multi-axis for Realism

No one in the vehicle industry welcomes the customer dissatisfaction, warranty cost, and hassles of annoying interior and exterior noises, including those that show up long after the vehicle is new. That is why MB Dynamics has earned a worldwide reputation for innovative Buzz, Squeak & Rattle (S&R) test solutions. Our technology focuses on helping you detect, diagnose, and eliminate these annoying sounds *before* the vehicle rolls off the assembly line. We will help you increase customer satisfaction, achieve best-in-class designation, and build your S&R brand image.

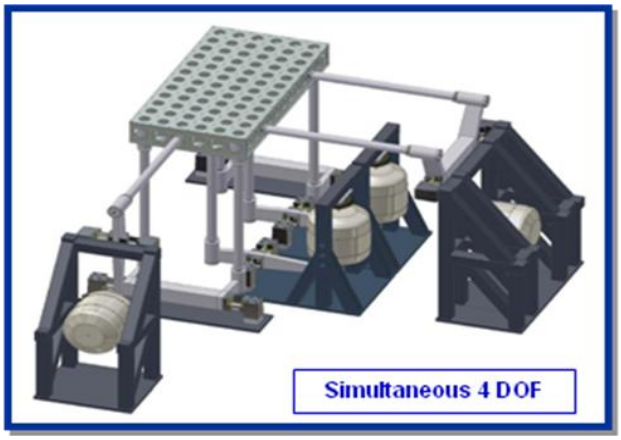
DSR: the Next Generation of S&R Technology

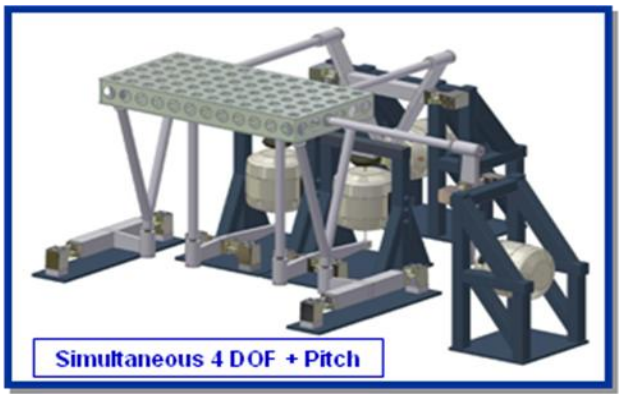
Merely proving that a vehicle, subsystem, or component is Squeak & Rattle-free when new does not assure customer satisfaction after 150,000 kilometers. That is why MB Dynamics is innovating next generation S&R testing technology with Durability Squeak & Rattle (DSR) systems built quiet for S&R, powerful for durability and multi-axis for realism.

Our DSR systems enable performing durability *and* S&R testing on the same equipment. The technology yields quiet testing for S&Rs, then testing at elevated acceleration levels to simulate accumulated mileage. Test cycles can be repeated endlessly – on the same equipment – for significant productivity advantages. And, shorter test times. And, fewer hassles juggling test items/schedules. And, no hydraulics.

Our systems allow 24/7 S&R testing. By using permanent magnets rather than field coils, heat is minimal. Therefore, we have eliminated the distracting sounds normally associated with cooling the exciters. Our patented flexures and innovative fixture design further reduce test equipment noise. The nearly silent operation allows for easier detection of road-induced annoying noises. Ours are "best-in-class" quiet.

"Simultaneous 4 DOF" and "4 DOF + Pitch" – Another DSR Technology from MB





- **"Simultaneous 4 DOF" delivers 4 simultaneous axes of vibration controlled independently using 4 exciters: vertical, roll, fore-aft and lateral**
- **"Simultaneous 4 DOF + Pitch" configured to deliver 5 axes with pitch coupled to fore-aft**
- **Excellent reproduction of important DOFs for S&R**
- **Sequential 1-axis-at-a-time testing for diagnoses of S&R issues; conforms to GMW14011**
- **Very quiet, compared to hydraulic MAST; test equipment noise does not mask S&Rs**
- **Perform DSR tests on payloads up to 350kg**
- **One test system is quiet enough for S&R and powerful enough for durability; don't need 2 different test systems**
- **Use in thermal chamber: -40°C to 50°C + humidity**
- **Find S&Rs not noticed at ambient temperatures; perform combined vibration and environmental DSR; don't need 2 different test systems**
- **Reproduce road time histories, sine sweeps, and PSD random profiles**
- **Quiet and favorable price-performance compared to hydraulic MAST**

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www.mbdynamics.com • Specifications subject to change without notice (0210)

Lab Test Equipment & Specifications

- Vibration Exciter System for BSR and S&R Detection of Automotive Modules and Full Vehicles
- Capable of mounting test items or modules (Instrument panel, Consoles, Body Bucks, Cockpits, Seats, Front & Rear side Doors, HVAC system, Sunroofs, Headliners, Steering Columns, Airbag modules, Seat Belt Retractors and Roof rails) in the "in-vehicle" mounting position or orientation
- Capable of being configured for S&R testing of full vehicles and trimmed bodies using 2 of 4 Energizers
- Test system is very quiet; Background Noise complies with GMW14011: 1.5 sones N10 when running a typical S&R test
- All Energizer exciters are electrodynamic, not hydraulic
- Frequency range of system: 5 - 100 Hz, for S&R; usable from 1 - 200 Hz
- No exciter cooling needed during S&R tests
- All Energizers use 2:1 Force-Multiplying lever arms to transfer exciter energy to module mounting rig or full vehicle
- Air spring between vertical Energizers & base supports dead weight of module mounting rig & payload
- Servo-controlled air spring maintains module mounting rig or full vehicle at Energizer's mid-stroke
- Vertical Energizers mount on base masses; not necessary to bolt them to floor as they have enough inertia to stay in position; air casters allow movement by one person over smooth chamber floors
- This mobility allows Energizers to be re-positioned for full vehicle testing separate from module rig
- Fore-aft and Lateral Energizers bolt to the floor for structural support; not necessary for them to move
- All Energizers have thermal shutdown circuits to protect them from overheating
- All Energizers have stiff load support to resist large overturning moments due to side loads
- Module Mounting Table size: 1549mm x 635mm
- Mounting Table Bolt-hole Grid Pattern: 150mm square using M10-1.5 threads
- Mounting Table is stiff but lightweight, fabricated from magnesium
- Height of mounting table from floor: ≤ 1.45m
- Following performance assumes the equipment is used for Durability Squeak & Rattle (DSR):
    - 315kg seat (45kg seat + three 75kg dummies + 45kg fixture) yields 0.8 gRMS and 3.2 g's peak random instantaneous; 1.0 g peak for sine vibration
    - 150kg IP (90kg IP + 60kg Universal Fixture Tubes) yields 1.2 gRMS and 4.8 g's peak random instantaneous; 1.0 g peak for sine vibration
    - Bare table, no payload yields 2.1 gRMS random and 1.0 g peak for sine vibration
    - For S&R only, accelerations would be 50% of these values
- Mounting Table has pair of torsion bar assemblies to restrain pitch achieving pure fore-aft motion
- Mounting Table also has a pair of wishbone assemblies to couple pitch with fore-aft motion (4+1 DOF)
- Universal Fixture Kit – 1/4" tube wall thickness, M8 – 1.25 screws – consists of a system of high stiffness aluminum tubes with threaded holes in a general purpose pattern and flanges for connecting tubes to one another and to the mounting table for fixturing and supporting modules
- Equipment provided to support full vehicle testing includes wheel stands, portable lift to raise vehicle onto wheel stands, and mechanical clamps for attaching lever-arm stingers to vehicle at stiff body connect points
- Input power required: 220VAC, single phase, 50/60 Hz; amplifiers mounted in 19" cabinet
- Vibration Controller can be operated in MIMO (Multi-Input, Multi-Output) mode for controlling PSD Random and Time History tests (road drive file replication) and MISO (Multi-Input, Single-Output) mode for sine vibration (one axis at a time) for diagnostics
- Controller simultaneously compensates for the cross-coupled dynamic responses from multiple shakers
- MIMO Controller uses techniques and proprietary algorithms including impulse response conditioning, time-domain feedback, and predictive noise-quelling
- MIMO Controller is PC-based, running under Windows XP, with 22" LCD display
- MIMO Controller has 8 input channels with built-in IEPE signal conditioning, user-configured for control or monitor, and 4 output channels
- User may adjust test amplitude during operation; Alarm/Abort limits are user-defined; level and test scheduling is available; sweep mode may be linear or logarithmic; test duration is user-defined
- Data may be saved during and at the end of a test and can be post processed and plotted at any time
- Results may be exported via ASCII to MS Windows applications
- Continuous loop check for safety & protection
- PC Extender: Remotes Monitor, Keyboard & Mouse 15m from PC